

**APPENDIX Q**  
**GEOLOGIC HAZARD STUDY;**  
**GEOTECHNICAL INVESTIGATION**

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## APPENDIX Q

### GEOLOGIC HAZARD STUDY GEOTECHNICAL INFORMATION COLUSA POWER PLANT

#### Q.1 FIELD EXPLORATION

As part of the Colusa Power Plant Geologic Hazards Study, URS performed a field exploration program consisting of four borings with the principal objective of collecting geotechnical data necessary for evaluating the engineering characteristics of the subsurface soil strata. Three borings were drilled to depths of approximately 50 feet, and one boring was drilled to 80 feet. The locations of the borings, shown on Figure Q-1, were chosen to evaluate the subsurface conditions across a broad area of the proposed site to provide a preliminary geotechnical characterization of the site. Soil samples were collected at 5-foot intervals using the Standard Penetration Test (SPT) sampler and the Dames & Moore U-sampler. The soil samples were examined in the field by a URS geologist and classified according to the Unified Soil Classification System (USCS). Logs of the borings are presented on Plates Q1-1 through Q1-4. A soil classification chart and key to the test data are presented on Plate Q1-5.

A geotechnical laboratory testing program was performed on selected samples from the field exploration program to determine the index and engineering properties of the subsurface soils. Geotechnical testing was performed by Signet Testing Labs, a URS company, at their Hayward, California facility. Results of the index and direct shear tests are summarized on Table Q-1 and are included on the boring logs on Plates Q1-1 through Q1-4. Grain size distributions are shown on Plates Q2-1 through Q2-8. Direct shear results are shown on Plate Q2-9.

#### Q.2 SUBSURFACE CONDITIONS

The subsurface soils to the maximum depth explored (80 feet) can be divided into two strata: the Surficial Clay and the Silty Deposit.

**Surficial Clay:** The Surficial Clay consists of a 2 to 8 feet thick, medium stiff to very stiff dark brown clay to sandy clay with trace amounts of roots. In borings B1, B2, and B3, the clay was classified as a lean clay (CL), and in B4 the surficial clay was a fat clay (CH). Laboratory tests indicate that the surficial clay layer has a high to very high swell potential with plasticity index results ranging from 25 to 37 percent. The natural water content of the clay was measured at 18.9 percent and 22.5 percent in borings B2 and B4, respectively, whereas the plastic limit was measured at 22 percent and 19 percent, respectively. Because the natural moisture level is very close to the plastic limit of this soil, the introduction of moisture will cause this soil to swell.

**Silty Deposit:** The Silty Deposit was explored to a depth of approximately 50 feet in B1, B2, and B4, and to a maximum depth of 80 feet in B3. This unit generally consists of very stiff to hard, brown, light brown, and brownish yellow silt to sandy silt with varying amounts of clay interbedded with occasional silty sand and lean clay lenses. In the deeper boring (B3), the color below 60 feet was a dark greenish gray. This may be an indication of the groundwater table, because all the soils above the depth of 60 feet were various shades of brown, which could reflect oxidation as a result of exposure to air. Laboratory tests indicate that the moisture content for the Silty Deposit above a depth of 10 feet ranged from 17 to 18 percent. Below 10 feet, the water content was slightly higher, ranging from 19 to 25 percent. Total density was more scattered, with values ranging from 108 to 130 pounds per cubic foot.

### **Q.3 PRELIMINARY CONCLUSIONS**

The selection of the foundation support system for the proposed structures must satisfy the requirements of support for the imposed loads while controlling settlements under the proposed structures within tolerable limits.

#### **Q.3.1 EXPANSIVE SURFICIAL CLAY**

The Surficial Clay layer ranges in thickness from 2 to 8 feet and has a high to very high swell potential with a plasticity index ranging from 25 to 37 percent, and natural moisture contents at or near the plastic limit. This layer should *not* be considered as a competent foundation layer. The introduction of moisture will cause this clay to swell and exert significant and potentially damaging heave pressures on any medium to light-weight structure placed upon the clay surface. This clay should be stripped and removed prior to construction.

#### **Q.3.2 LIQUEFACTION POTENTIAL**

URS evaluated liquefaction potential for the project site based on subsurface data obtained from the field investigation. It is generally recognized that liquefaction will occur in saturated, loose to medium dense sands and silty sands during moderate to strong ground shaking from earthquakes. Conventional evaluation of liquefaction in sands involves evaluation of in situ density and resistance to cyclic stresses based on penetration resistance data (Youd and Idriss, 1996; Seed et al., 1983). This approach is valid typically for clean sands to silty sands with no greater than 35 to 45 percent fines content by weight. Based on field identification and laboratory tests, the silty sand lenses within the Silty Deposit generally have between 12 and 40 percent fines content. Based on observed typical penetration resistance values of greater than 30 blows per foot, these lenses are too dense to be subject to liquefaction under moderate to strong ground shaking.

Significant cyclic loss of strength and settlements can potentially occur in saturated, soft, non-plastic and low-plasticity plastic silts. The four borings drilled for this investigation indicated that the silts were all very stiff to hard with blow counts exceeding 40 blows per 12 inches of drive. Therefore, URS does not believe the silts within the Silty Deposit will be subject to liquefaction.

#### **Q.3.3 PRELIMINARY FOUNDATION CONCEPTS**

The Silty Deposit consists of very stiff to hard silts to sandy silts interbedded with silty sand and lean clay lenses. This layer can provide competent foundation support and does not present a liquefaction hazard.

Three options have been considered for foundation design: (1) a mat foundation; (2) a drilled pier foundation; or (3) a driven pile foundation. If a mat foundation is considered, the most important foundation design consideration will be the allowable differential settlement. Very heavy power-generating turbines may not be able to tolerate much differential foundation settlement. Therefore, the mat foundation design must carefully consider the compressibility characteristics of the underlying silts and any thin clay lenses that may be present.

Drilled piers would rely primarily on either shaft friction or end-bearing resistance in the very stiff to hard silts of the Silty Deposit. This foundation system can be installed without casing by the dry method, provided that the groundwater table is below the bottom depth of the drilled piers and the soils are not subject to caving. Based on the four preliminary borings, it appears that the drilled piers could be installed in this manner.

A driven pile foundation can rely upon the end-bearing and frictional support provided by the Silty Deposit. Based on the preliminary information, driven piles most likely would be designed as friction elements. Pre-drilling would be required to design driven piles as end-bearing elements.

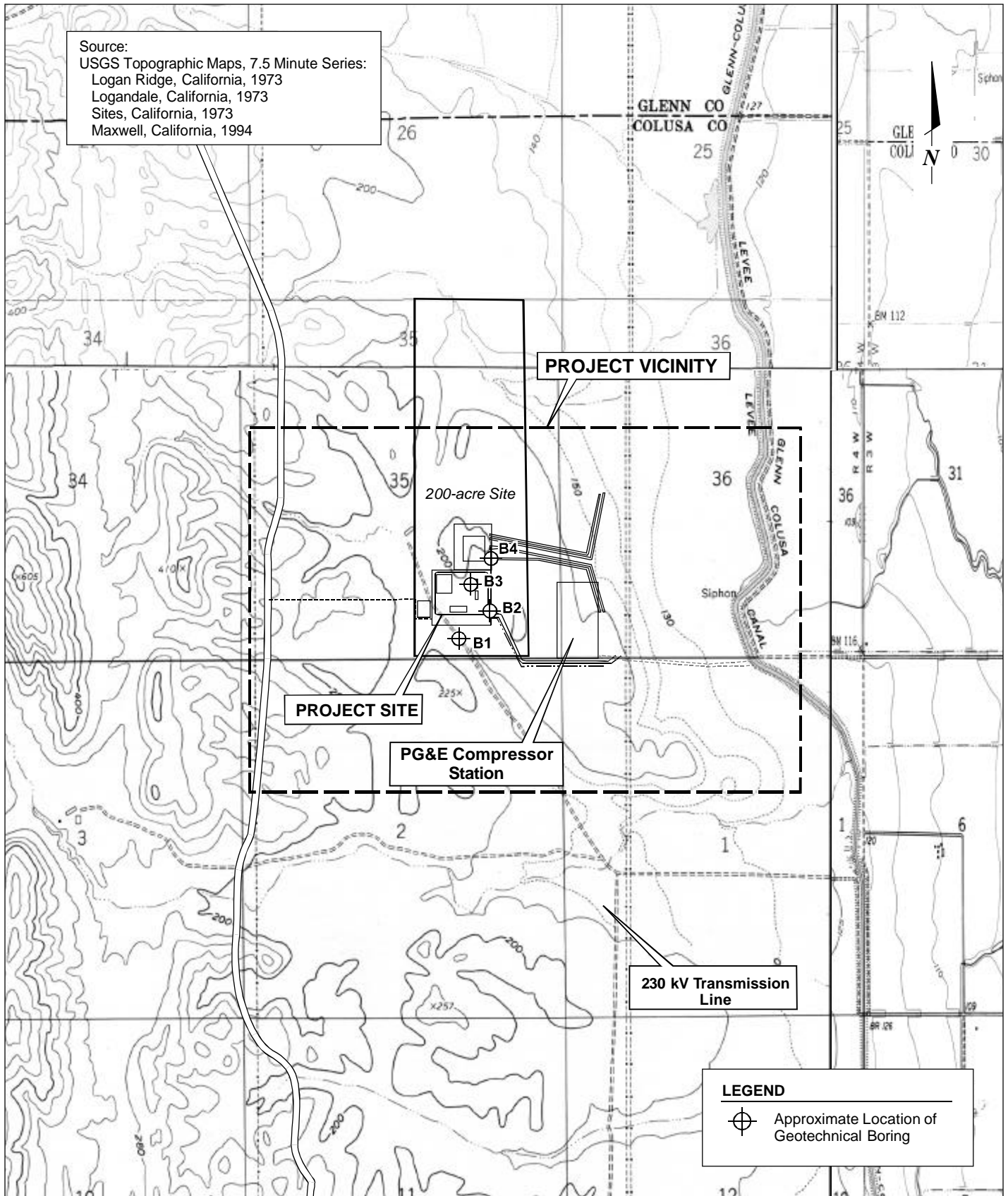
Future geotechnical investigations for foundation design should focus on the strength characteristics of the silts throughout the Silty Deposit and the compressibility behavior of the shallower silts and the clay lenses.

#### **Q.4 REFERENCES**

- Seed, H.B., I.M. Idriss, and I. Arrango, 1983. "Evaluation of Liquefaction Potential Using Field Performance Data," *Journal of Geotechnical Engineering*, Vol. 111, No. 12, pp. 1425-1445.
- Youd, T.L. and Idriss, I.M. (ed.), 1996. "Proceedings of the NCEER Workshop on Evaluation of Liquefaction Resistance of Soils," National Center for Earthquake Engineering Research, Salt Lake City, January 5-6, 1996.

**Table Q-1**  
**Summary of Laboratory Index Test Results**

Boring	Depth (ft)	Soil Type	Moisture Content (%)	Total Density (pcf)	Dry Density (pcf)	Passing #200 Sieve (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index	Other Tests
B1	5.0	SM	13.8	113.8	100.0	40				
	10.0	ML	16.7							
	15.0	ML	24.3	125.1	100.6					
	20.0	ML	22.7							
	25.0	SM				41				SA
	30.0	SM	20.1							
	40.0	ML	23.7							
B2	3.0	CL	18.9			69	47	22	25	SA
	10.0	ML	15.1							
	15.0	ML	21.2	129.0	106.4					
	20.0	ML	24.6							
	30.0	ML	22.5							
	35.0	ML	22.1							
	50.0	ML	24.1							
B3	5.0	ML	13.2			59				SA
	10.0	ML	18.1	108.4	91.8					
	15.0	CL	22.4			79	44	26	18	
	20.0	ML	19.4	125.4	105.0					
	25.0	ML				70				SA
	25.0	ML	21.4	114.5	94.3					DSCD
	25.0	ML	22.0	114.2	93.6					DSCD
	25.0	ML	23.7	112.6	91.0					DSCD
	30.0	ML	24.5	126.6	101.7					
	35.0	ML	20.3							
	45.0	ML	25.0							
	55.0	ML	27.0							
	60.0	CL	23.5	128.1	103.7	70	39	24	15	SA
	80.0	ML	20.6							
B4	0.0	CH	22.5			83	56	19	37	SA
	5.0	ML	14.7	110.7	96.5					
	10.0	ML	13.2	120.6	106.5					
	15.0	ML	22.9							
	20.0	SM				18				SA
	25.0	ML	21.2							
	40.0	ML	22.5	129.9	106.0					
	45.0	ML	22.2							
	50.0	ML	19.3							
Notes: SA = Sieve Analysis DSCD = Consolidated Drained Direct Shear										



## PLOT PLAN

Colusa Power Plant

Reliant Energy













Colusa County, California

43-00066841.00

**URS**

**FIGURE Q-1**

# BORING B-1

LABORATORY TEST DATA									SAMPLING				
DEPTH IN FEET	TESTS REPORTED ELSEWHERE	ATTERBERG LIMITS		STRENGTH DATA			MOISTURE CONTENT (%)	DRY DENSITY (PCF)	TYPE OF SAMPLER	SAMPLING RESISTANCE	SAMPLES	SYMBOL	DESCRIPTION
		LIQUID LIMIT (%)	PLASTICITY INDEX (%)	TYPE OF TEST	NORMAL OR CONFINING PRESSURE (PSF)	SHEAR STRENGTH (PSF)							
0									BULK			ML	DARK BROWN CLAYEY SILT to SILTY CLAY, trace sand, roots, moist, medium stiff.
												SM	BROWN SILTY FINE SAND, trace clay, some concretions, mottled, dry to moist, dense.
5									U	64			
												ML	BROWN SILT, trace sand, trace concretions, moist, hard.
10									SPT	41			
									U	64			Pocket Penetrometer Qu > 9,000 psf Torvane Qu = 9,000 psf
													Grades less sand.
20									SPT	43			
									U				BROWNISH YELLOW SILT, trace coarse to fine sand, moist, hard. Pocket Penetrometer Qu = 5,000 psf Torvane Su = 2,500 psf
25													Grades trace clay.
									SPT	59			
30												ML	BROWN SILT, trace clay, sand, moist, hard.
35													

Continued Next Page

Job No: 46800-930-043	<b>URS</b> Dames & Moore	<b>Log of Boring</b>
Pt. ID: RELIANT.GPJ / B-1		
Date Completed: 3/23/01	Surface Elev: 168.5 feet (NGVD)	Location: Colusa County
Boring Depth: 51.5 ft.	Coordinates:	



# BORING B-1

LABORATORY TEST DATA									SAMPLING				
DEPTH IN FEET	TESTS REPORTED ELSEWHERE	ATTERBERG LIMITS		STRENGTH DATA			MOISTURE CONTENT (%)	DRY DENSITY (PCF)	TYPE OF SAMPLER	SAMPLING RESISTANCE	SAMPLES	SYMBOL	DESCRIPTION
		LIQUID LIMIT (%)	PLASTICITY INDEX (%)	TYPE OF TEST	NORMAL OR CONFINING PRESSURE (PSF)	SHEAR STRENGTH (PSF)							
35									U	50/3"	■		
40									SPT	86	▮		
45									U	50/6"	■		
50									SPT	90	▮		
55													
60													
65													
70													

Notes:

- Boring completed to a depth of 51.5 feet on March 23, 2001, and was backfilled with cement grout.
- Boring log indicates interpreted subsurface conditions only at the location and the time that the borehole was drilled.
- Sampling resistance for "SPT" and "U" samplers measured in blows per foot to drive the sampler 12 inches after an initial seating depth at 6 inches, and using a 140 lb hammer dropping 30 inches.
- Groundwater was not measured due to the drilling method.

## Notes:

1. Boring completed to a depth of 51.5 feet on March 23, 2001, and was backfilled with cement grout.
2. Boring log indicates interpreted subsurface conditions only at the location and the time that the borehole was drilled.
3. Sampling resistance for "SPT" and "U" samplers measured in blows per foot to drive the sampler 12 inches after an initial seating depth at 6 inches, and using a 140 lb hammer dropping 30 inches.
4. Groundwater was not measured due to the drilling method.

Job No: 46800-930-043  
Pt. ID: RELIANT.GPJ / B-1

**URS**  
Dames & Moore

Log of Boring

# BORING B-2

LABORATORY TEST DATA									SAMPLING				
DEPTH IN FEET	TESTS REPORTED ELSEWHERE	ATTERBERG LIMITS		STRENGTH DATA			MOISTURE CONTENT (%)	DRY DENSITY (PCF)	TYPE OF SAMPLER	SAMPLING RESISTANCE	SAMPLES	SYMBOL	DESCRIPTION
		LIQUID LIMIT (%)	PLASTICITY INDEX (%)	TYPE OF TEST	NORMAL OR CONFINING PRESSURE (PSF)	SHEAR STRENGTH (PSF)							
0													ML BROWN SILTY with sand, trace clay, very stiff, moist to dry.
5									U				
10									SPT	88			ML
15									U	13/50			grades to brown to light brown. Pocket Penetrometer: Su > 4,500 psf
20									SPT	47			ML BROWN TO LIGHT BROWN SILT, trace clay, trace fine sand, stiff, moist.
25									U				
30													CL ML BROWN SILT, trace clay, fine sand, stiff, moist. Pocket Penetrometer Su = 3,000 psf
35													

Continued Next Page

Job No: 46800-930-043	<b>URS</b>	<b>Log of Boring</b>
Pt. ID: RELIANT.GPJ / B-2	Dames & Moore	
Date Completed: 3/23/01	Surface Elev: 193.5 feet (NGVD)	Location:
Boring Depth: 51.5 ft.	Coordinates:	Colusa County

# BORING B-2

DEPTH IN FEET	LABORATORY TEST DATA								SAMPLING	
	ATTERBERG LIMITS		STRENGTH DATA			MOISTURE CONTENT (%)	DRY DENSITY (PCF)	TYPE OF SAMPLER	SAMPLING RESISTANCE	
	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	TYPE OF TEST	NORMAL OR CONFINING PRESSURE (PSF)	SHEAR STRENGTH (PSF)					
35										
40								SPT	83	
45								SPT	80	
50								SPT	75	
55										
60										
65										
70										

SAMPLES

SYMBOL

DESCRIPTION



## Notes:

1. Boring completed to a depth of 51.5 feet on March 23, 2001, and was backfilled with cement grout.
2. Boring log indicates interpreted subsurface conditions only at the location and the time that the borehole was drilled.
3. Sampling resistance for "SPT" and "U" samplers measured in blows per foot to drive the sampler 12 inches after an initial seating depth at 6 inches. Using a 140 lb hammer dropping 30 inches.
4. Groundwater was not measured due to the drilling method.

Job No: 46800-930-043  
Pt. ID: RELIANT.GPJ / B-2

**URS**  
James & Moore

Log of Boring

Log Template: 1A

May 2, 2001

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PLATE Q1-2 (Cont.)

# BORING B-3

LABORATORY TEST DATA										SAMPLING				
DEPTH IN FEET	TESTS REPORTED ELSEWHERE	ATTERBERG LIMITS		STRENGTH DATA			MOISTURE CONTENT (%)	DRY DENSITY (PCF)	TYPE OF SAMPLER	SAMPLING RESISTANCE	SAMPLES	SYMBOL	DESCRIPTION	
		LIQUID LIMIT (%)	PLASTICITY INDEX (%)	TYPE OF TEST	NORMAL OR CONFINING PRESSURE (PSF)	SHEAR STRENGTH (PSF)								
0													ML	DARK BROWN CLAYEY SILT, little roots, stiff, moist.
5									SPT				ML	BROWN TO LIGHT BROWN (TAN) SILT with some concretions, stiff, moist.  Pocket Penetrometer Su = 2,000 psf
10									U	43/50				Torvane Su = 1,250 psf
15									SPT	66			ML	BROWN CLAYEY SILT with trace sand, very stiff, mottled reddish brown, moist.  Pocket Penetrometer Su = 3,250 psf
20									U	40/50				BROWN SILT WITH SAND.  Torvane Su = 1,250 psf
25									U					grades to little clay  Torvane Su = 2,000 psf  Pocket Penetrometer Su = 2,000 psf
30									U					Pocket Penetrometer Su = 2,600 psf  Torvane Su = 1,400 psf
35													ML	BROWNISH YELLOW SANDY SILT, hard, moist.

Continued Next Page

Job No: 46800-930-043	<b>URS</b>	<b>Log of Boring</b>
Pt. ID: RELIANT.GPJ / B-3	Dames & Moore	
Date Completed: 3/22/01	Surface Elev: 177.5 feet (NGVD)	Location: Colusa County
Boring Depth: 80.0 ft.	Coordinates:	

# BORING B-3

LABORATORY TEST DATA									SAMPLING				
DEPTH IN FEET	TESTS REPORTED ELSEWHERE	ATTERBERG LIMITS		STRENGTH DATA			MOISTURE CONTENT (%)	DRY DENSITY (PCF)	TYPE OF SAMPLER	SAMPLING RESISTANCE	SAMPLES	SYMBOL	DESCRIPTION
		LIQUID LIMIT (%)	PLASTICITY INDEX (%)	TYPE OF TEST	NORMAL OR CONFINING PRESSURE (PSF)	SHEAR STRENGTH (PSF)							
35									SPT				
40									U	35/50			BROWN CLAYEY SILT with trace sand, mottled, hard, moist.  Pocket Penetrometer Su = 4,500 psf  Torvane Su = 2,500 psf
45									SPT	86			Pocket Penetrometer Su = 2,500 psf
50									U	50			Pocket Penetrometer Su = 4,500 psf
55									SPT	67			grades with little sand.
60									U				DARK GREENISH GRAY SILT WITH SAND, hard, massive.  Pocket Penetrometer Su = 4,500 psf
65													
70												ML	DARK GREENISH GRAY SANDY SILT, hard with trace gravels.

Continued Next Page

Job No: 46800-930-043  
Prt. ID: RELIANT.GPJ / B-3

**URS**  
Dames & Moore

**Log of Boring**

# BORING B-3

DEPTH IN FEET	LABORATORY TEST DATA							SAMPLING	
	ATTERBERG LIMITS		STRENGTH DATA			MOISTURE CONTENT (%)	DRY DENSITY (PCF)	TYPE OF SAMPLER	SAMPLING RESISTANCE
	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	TYPE OF TEST	NORMAL OR CONFINING PRESSURE (PSF)	SHEAR STRENGTH (PSF)				
70								U	50
75									
80								SPT	20/50
85									
90									
95									
100									
105									

SAMPLES

SYMBOL

DESCRIPTION

Torvane Su = 2,500 psf

DARK GREENISH CLAYEY SILT with sand

Pocket Penetrometer Su = 3,000 psf

Job No: 46800-930-043  
Pt. ID: RELIANT.GPJ / B-3

**URS**  
Dames & Moore

Log of Boring

Log Template: 1A

May 2, 2001

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PLATE Q1-3 (Cont.)

# BORING B-4

LABORATORY TEST DATA									SAMPLING	
DEPTH IN FEET	TESTS REPORTED ELSEWHERE	ATTERBERG LIMITS		STRENGTH DATA			MOISTURE CONTENT (%)	DRY DENSITY (PCF)	TYPE OF SAMPLER	SAMPLING RESISTANCE
		LIQUID LIMIT (%)	PLASTICITY INDEX (%)	TYPE OF TEST	NORMAL OR CONFINING PRESSURE (PSF)	SHEAR STRENGTH (PSF)				
0										
5									U	73
10									U	24/50
15									SPT	52
20									U	8/50
25									SPT	54
30									U	50
35										

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Continued Next Page

Job No: 46800-930-043	<b>URS</b>	Log of Boring
PL ID: RELIANT.GPJ / B-4	Dames & Moore	
Date Completed: 3/22/01	Surface Elev: 188.0 feet (NGVD)	Location: Colusa County
Boring Depth: 51.0 ft.	Coordinates:	

# BORING B-4

LABORATORY TEST DATA									SAMPLING	
DEPTH IN FEET	TESTS REPORTED ELSEWHERE	ATTERBERG LIMITS		STRENGTH DATA			MOISTURE CONTENT (%)	DRY DENSITY (PCF)	TYPE OF SAMPLER	SAMPLING RESISTANCE
		LIQUID LIMIT (%)	PLASTICITY INDEX (%)	TYPE OF TEST	NORMAL OR CONFINING PRESSURE (PSF)	SHEAR STRENGTH (PSF)				
35									SPT	72
40									U	50
45									SPT	84
50									SPT	28/50
55										
60										
65										
70										

SAMPLES

SYMBOL

DESCRIPTION

Job No: 46800-930-043  
 Pt. ID: RELIANT.GPJ / B-4

**URS**  
 Davies & Moore

Log of Boring



Grain size distribution curve for a soil sample. The graph plots Percent Finer (Y-axis, 0 to 100) against Grain Size in mm (X-axis, logarithmic scale from 500 to 0.001). The curve shows that approximately 100% of the soil is finer than 4.75 mm, and about 40% is finer than 0.075 mm.

Grain Size (mm)	Percent Finer (%)
500	100
100	100
60	100
40	100
25	100
15	100
10	100
7.5	100
4.75	100
2.5	100
1.5	100
1.0	100
0.75	100
0.6	100
0.425	100
0.3	100
0.25	100
0.2	100
0.15	100
0.106	100
0.075	100
0.06	100
0.0425	100
0.03	100
0.025	100
0.02	100
0.015	100
0.0106	100
0.0075	100
0.006	100
0.00425	100
0.003	100
0.0025	100
0.002	100
0.0015	100
0.00106	100
0.00075	100
0.0006	100
0.000425	100
0.0003	100
0.00025	100
0.0002	100
0.00015	100
0.000106	100
0.000075	100
0.00006	100
0.0000425	100
0.00003	100
0.000025	100
0.00002	100
0.000015	100
0.0000106	100
0.0000075	100
0.000006	100
0.00000425	100
0.000003	100
0.0000025	100
0.000002	100
0.0000015	100
0.00000106	100
0.00000075	100
0.0000006	100
0.000000425	100
0.0000003	100
0.00000025	100
0.0000002	100
0.00000015	100
0.000000106	100
0.000000075	100
0.00000006	100
0.0000000425	100
0.00000003	100
0.000000025	100
0.00000002	100
0.000000015	100
0.0000000106	100
0.0000000075	100
0.000000006	100
0.00000000425	100
0.000000003	100
0.0000000025	100
0.000000002	100
0.0000000015	100
0.00000000106	100
0.00000000075	100
0.0000000006	100
0.000000000425	100
0.0000000003	100
0.00000000025	100
0.0000000002	100
0.00000000015	100
0.000000000106	100
0.000000000075	100
0.00000000006	100
0.0000000000425	100
0.00000000003	100
0.000000000025	100
0.00000000002	100
0.000000000015	100
0.0000000000106	100
0.0000000000075	100
0.000000000006	100
0.00000000000425	100
0.000000000003	100
0.0000000000025	100
0.000000000002	100
0.0000000000015	100
0.00000000000106	100
0.00000000000075	100
0.0000000000006	100
0.000000000000425	100
0.0000000000003	100
0.00000000000025	100
0.0000000000002	100
0.00000000000015	100
0.000000000000106	100
0.000000000000075	100
0.00000000000006	100
0.0000000000000425	100
0.00000000000003	100
0.000000000000025	100
0.00000000000002	100
0.000000	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.8		
#20	98.0		
#40	91.7		
#60	76.7		
#140	46.6		
#200	40.3		

Remarks

PLATE Q2-1

Grain size distribution curve showing Percent Finer versus Grain Size (mm). The curve is plotted on a semi-logarithmic scale, with the x-axis (Grain Size) ranging from 500 mm to 0.001 mm and the y-axis (Percent Finer) ranging from 0 to 100. The curve starts at 100% finer for grain sizes down to approximately 4.75 mm, then drops sharply, reaching approximately 42% finer at 0.075 mm.

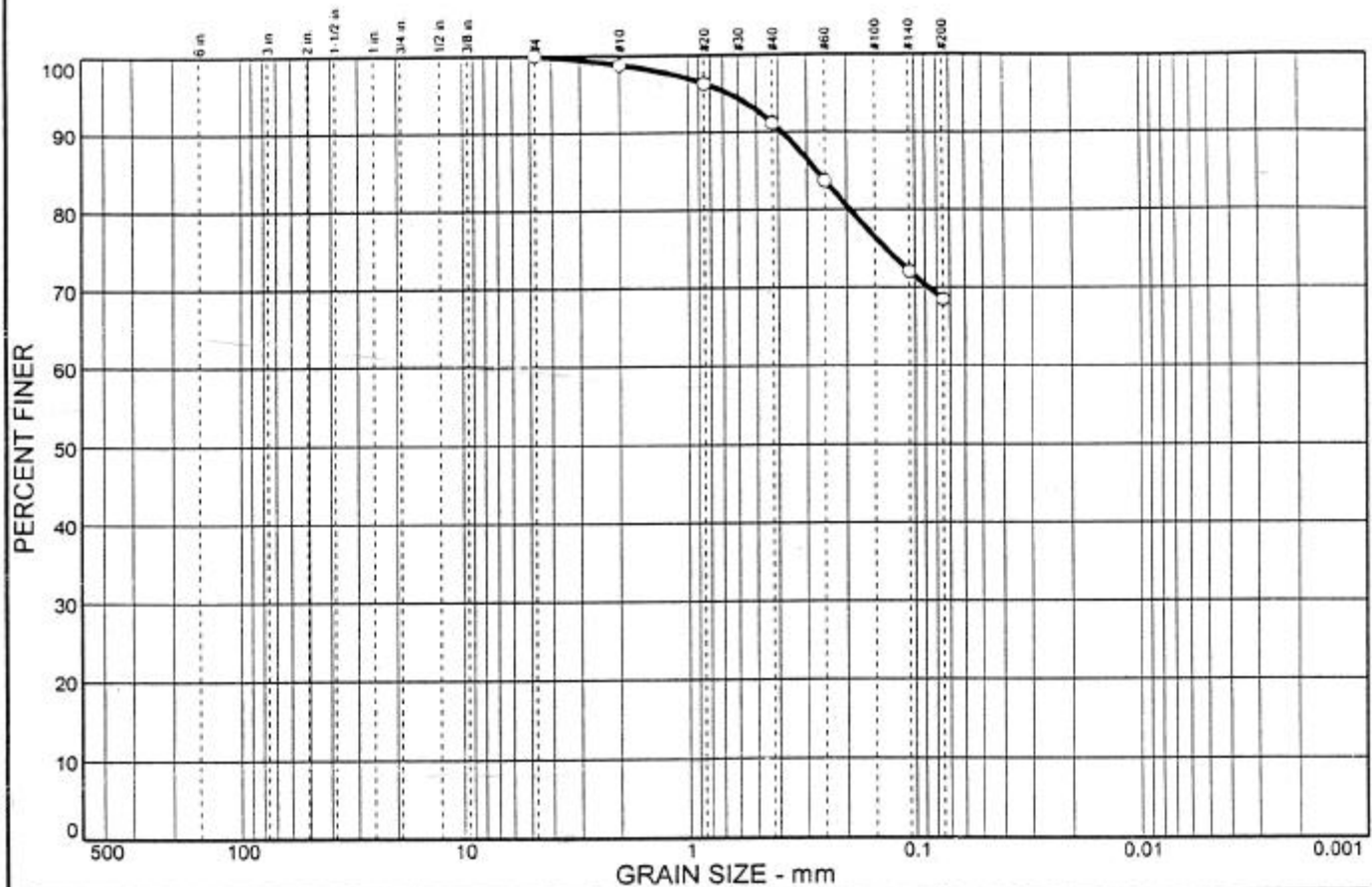
Grain Size (mm)	Percent Finer (%)
4.75	100
2.0	99
0.85	97
0.425	91
0.25	78
0.15	47
0.075	42

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	98.5		
#10	97.7		
#20	95.7		
#40	90.6		
#60	77.7		
#140	46.7		
#200	40.9		

Remarks

PLATE Q2-2

# Particle Size Distribution Report



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	0.0	1.2	7.7	22.6	68.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	98.8		
#20	96.3		
#40	91.1		
#60	83.7		
#140	72.1		
#200	68.5		

\* (no specification provided)

## Soil Description

Dark yellowish brown Sandy lean clay

## Atterberg Limits

PL= 22 LL= 47 PI= 25

## Coefficients

D<sub>85</sub>= 0.273 D<sub>60</sub>= D<sub>50</sub>=  
D<sub>30</sub>= D<sub>15</sub>= D<sub>10</sub>=  
C<sub>u</sub>= C<sub>c</sub>=

## Classification

USCS= CL AASHTO=

## Remarks

Sample No.:

Location:

Source of Sample: B-2

Date: 4-7-01

Elev./Depth: 2-3 ft

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Project: Reliant Energy Colusa County

Project No: 46800-930-043

Plate

# Particle Size Distribution Report



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	0.0	0.7	7.1	33.6	58.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.3		
#20	97.2		
#40	92.2		
#60	83.5		
#140	64.3		
#200	58.6		

(no specification provided)

**Soil Description**  
Olive yellow Sandy silt

**Atterberg Limits**  
 PL=      LL=      PI=

**Coefficients**  
 D<sub>85</sub>= 0.269      D<sub>60</sub>= 0.0821      D<sub>50</sub>=  
 D<sub>30</sub>=      D<sub>15</sub>=      D<sub>10</sub>=  
 C<sub>u</sub>=      C<sub>c</sub>=

**Classification**  
 USCS= ML      AASHTO=

**Remarks**

Sample No.: 2  
Location:

Source of Sample: B-3

Date: 4-7-01  
Elev./Depth: 5 ft

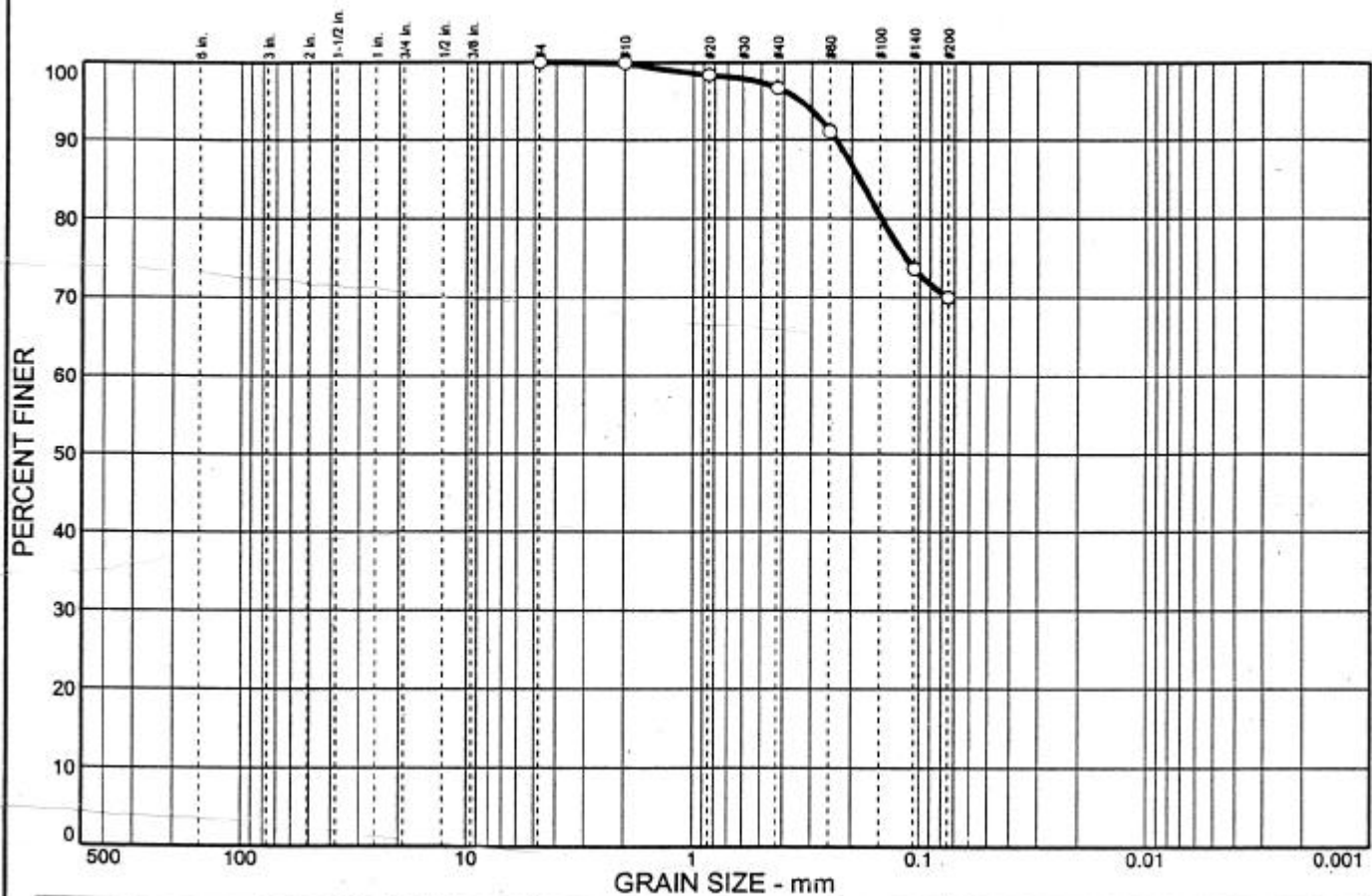
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# Particle Size Distribution Report



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	0.0	0.1	3.2	26.7	70.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.9		
#20	98.4		
#40	96.7		
#60	91.1		
#140	73.7		
#200	70.0		

\* (no specification provided)

**Soil Description**  
 Yellowish brown sandy silt

**Atterberg Limits**  
 PL=      LL=      PI=

**Coefficients**  
 D<sub>85</sub>= 0.185      D<sub>60</sub>=      D<sub>50</sub>=  
 D<sub>30</sub>=      D<sub>15</sub>=      D<sub>10</sub>=  
 C<sub>u</sub>=      C<sub>c</sub>=

**Classification**  
 USCS= ML      AASHTO=

**Remarks**

Sample No.: 6  
Location:

Source of Sample: B-3

Date: 4-13-01  
Elev./Depth: 25 ft

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The graph illustrates the grain size distribution of a soil sample. The y-axis represents the percentage of soil finer than a given grain size, ranging from 0 to 100. The x-axis represents the grain size in millimeters, on a logarithmic scale from 500 mm down to 0.001 mm. The curve shows that the soil is predominantly fine-grained, with most particles smaller than 60 mm. The data points are as follows:

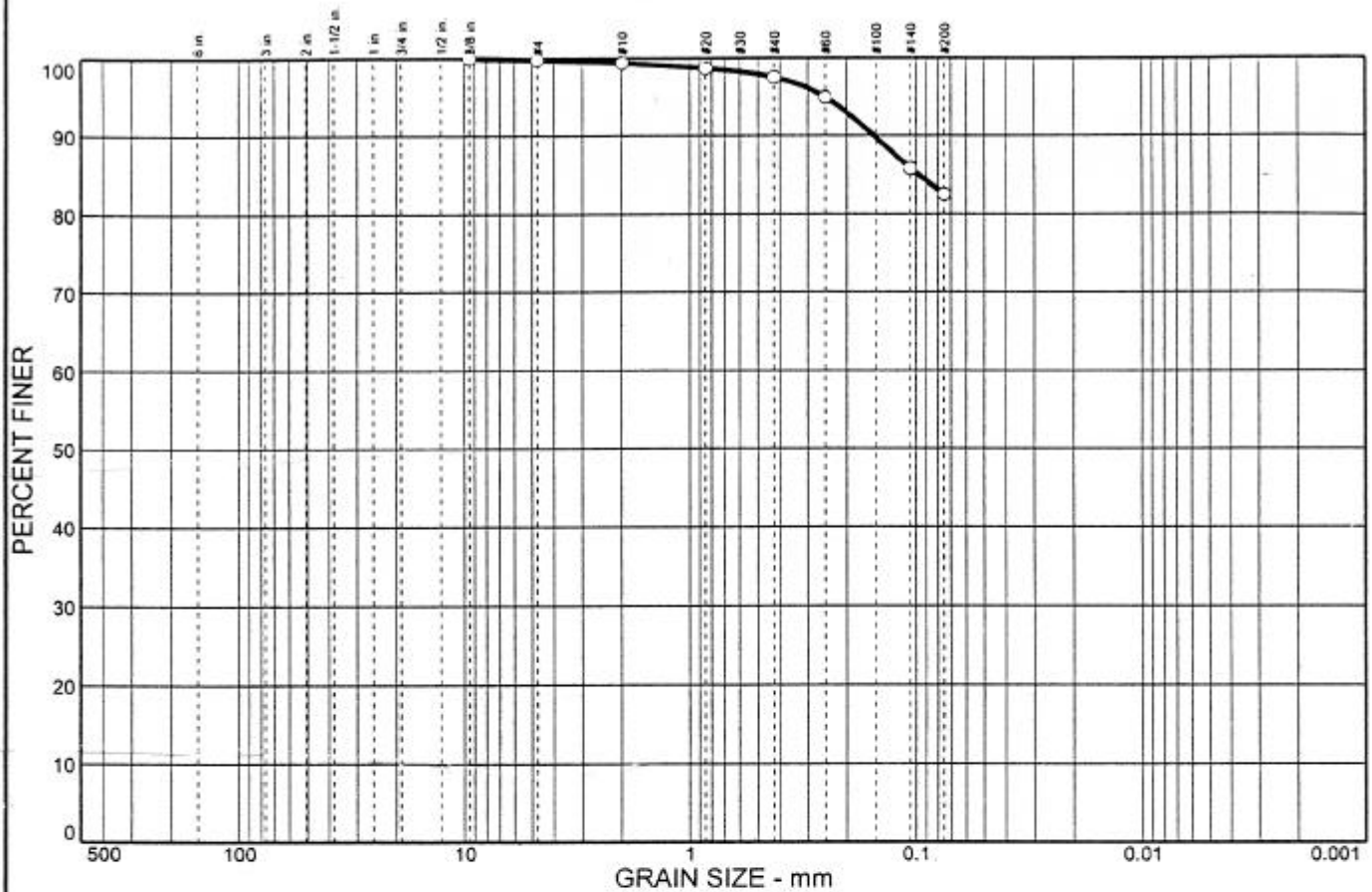
Grain Size (mm)	Grain Size (No.)	Percent Finer (%)
60	-	100
4.75	No. 40	100
2.0	No. 80	100
0.85	No. 20	96
0.425	No. 40	92
0.25	No. 60	86
0.15	No. 100	75
0.075	No. 200	71

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/2 in.	100.0		
3/8 in.	99.5		
#4	98.8		
#10	97.2		
#20	94.4		
#40	90.4		
#60	85.3		
#140	74.4		
#200	70.2		

Remarks

PLATE Q2-6

# Particle Size Distribution Report



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	0.2	0.4	1.9	15.0	82.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8 in.	100.0		
#4	99.8		
#10	99.4		
#20	98.7		
#40	97.5		
#60	94.9		
#140	85.8		
#200	82.5		

\* (no specification provided)

**Soil Description**  
Strong brown Fat clay with sand

**Atterberg Limits**  
 PL= 19      LL= 56      PI= 37

**Coefficients**  
 D<sub>85</sub>= 0.0980      D<sub>60</sub>=      D<sub>50</sub>=  
 D<sub>30</sub>=      D<sub>15</sub>=      D<sub>10</sub>=  
 C<sub>u</sub>=      C<sub>c</sub>=

**Classification**  
 USCS= CH      AASHTO=

**Remarks**

Sample No.: 1  
Location:

Source of Sample: B-4

Date: 4-10-01  
Elev./Depth: 0-5 ft

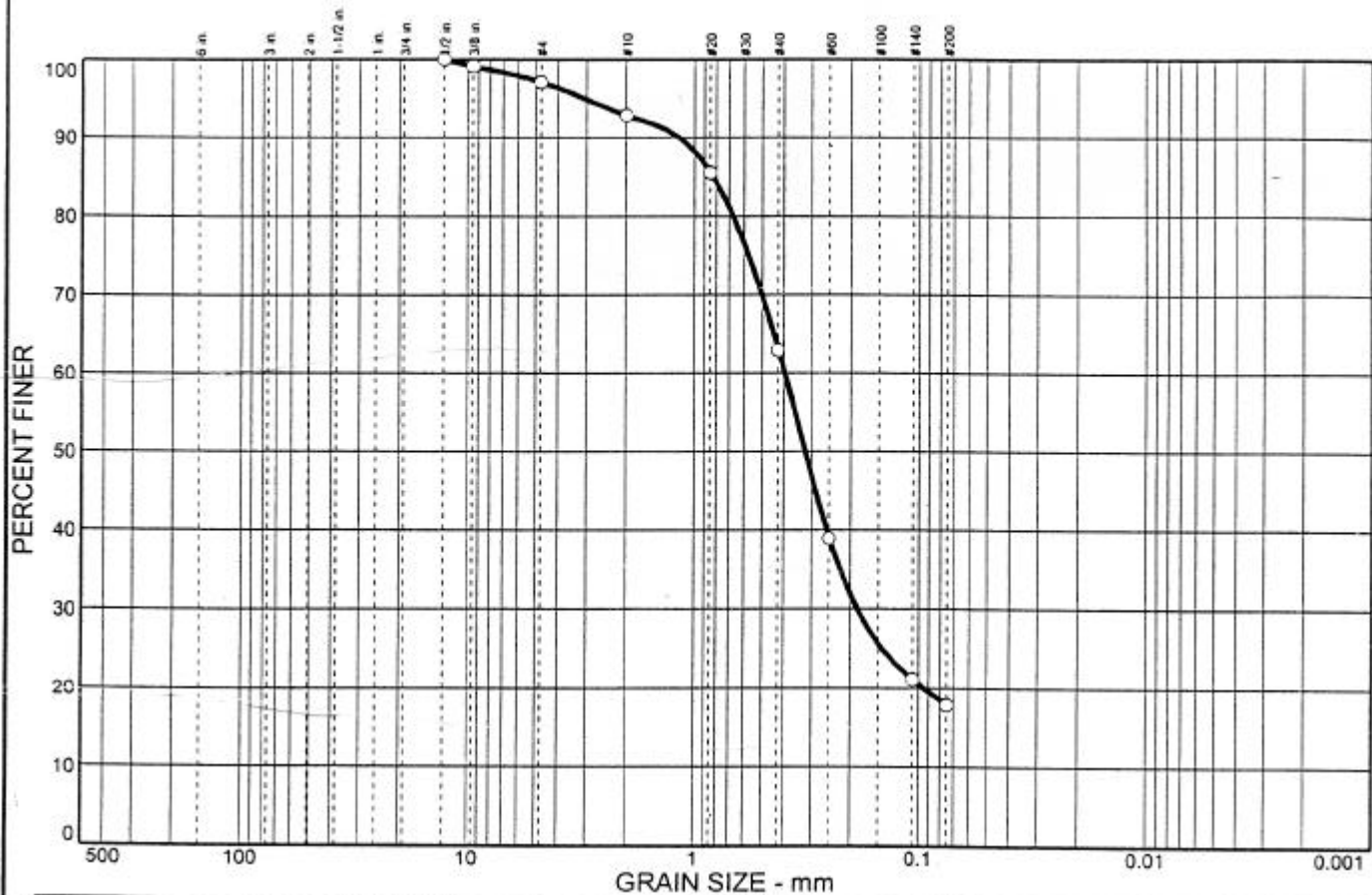
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Plate

# Particle Size Distribution Report



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	2.9	4.3	29.9	45.0	17.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/2 in.	100.0		
3/8 in.	99.1		
#4	97.1		
#10	82.8		
#20	85.5		
#40	62.9		
#60	38.9		
#140	21.1		
#200	17.9		

(no specification provided)

**Soil Description**  
 Dark yellowish brown Silty sand

**Atterberg Limits**  
 PL=      LL=      PI=

**Coefficients**  
 D<sub>85</sub>= 0.829      D<sub>60</sub>= 0.399      D<sub>50</sub>= 0.323  
 D<sub>30</sub>= 0.187      D<sub>15</sub>=      D<sub>10</sub>=  
 C<sub>u</sub>=      C<sub>c</sub>=

**Classification**  
 USCS= SM      AASHTO=

**Remarks**

Sample No.: 5  
Location:

Source of Sample: B-4

Date: 4-7-01  
Elev./Depth: 20 ft

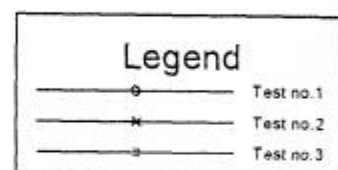
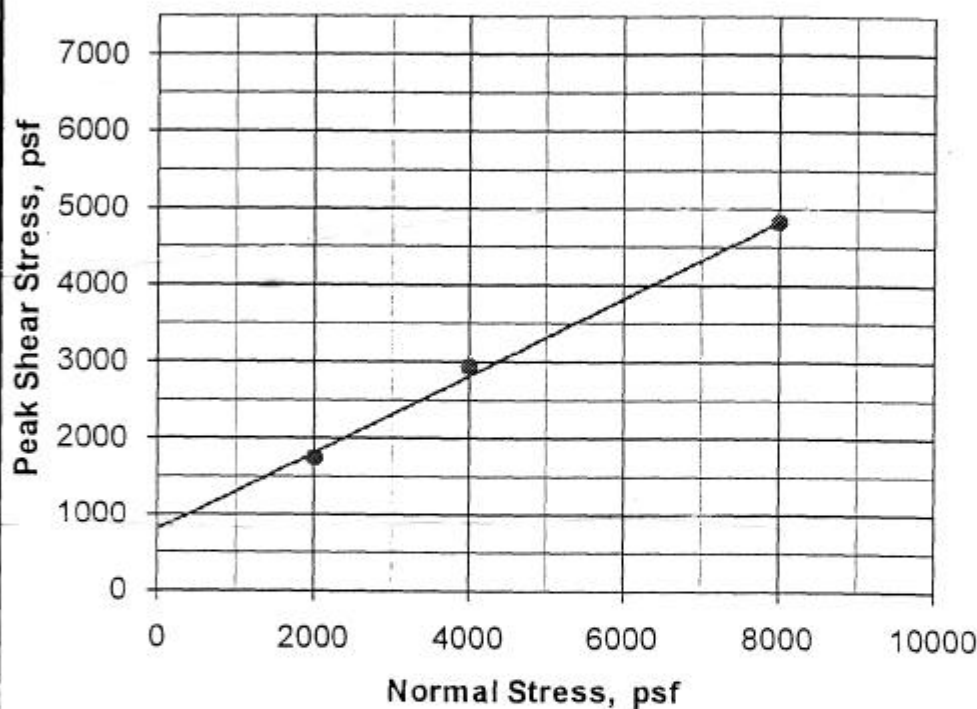
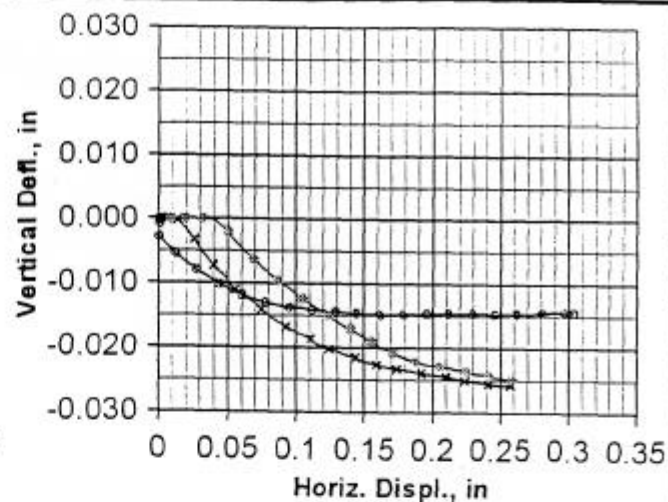
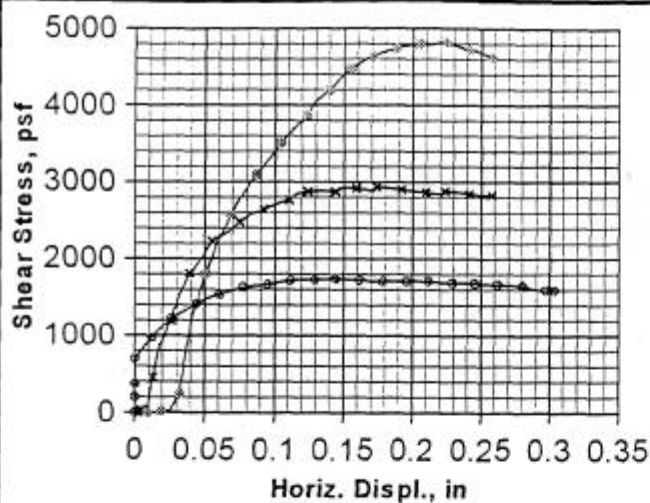
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Project No: 46800-930-043

Plate





**Results**

C = 800 psf  
phi = 27 deg.

Gs = 2.70  
Type = undisturbed

Test no.	SigN psf	Peak Shear str., psf	Displ. in.	Strain Rate in./hr	Initial MC %	Initial DD pcf	Initial Sat. %	Initial Void Ratio	Initial Ht. in.	Initial Dia. in.	Final MC %	Final DD pcf	Final Sat. %	Final Void Ratio	Final Ht. in.
1	2000	1740	0.144	0.05	21.4	94.3	73	0.787	1.00	2.416	26.2	97.9	98	0.721	0.963
2	4000	2935	0.174	0.05	22.0	93.6	74	0.800	1.00	2.416	25.9	101.6	106	0.659	0.922
3	8000	4822	0.224	0.05	23.7	91.0	75	0.852	1.00	2.416	28.4	101.2	115	0.665	0.899

Client: URS/Dames & Moore

Boring #: B-3

Sample #: S-6

Project: Reliant Energy Colusa County

Depth (ft): 25

Project #: 46800-930-843

Soil: Yellowish Brown Silty Clay

**TEST REPORT:** Direct shear - inundated, consolidated, & drained test